DOCUMENT RESUME

ED 118 157 IR 003 078

AUTHOR Ausburn, Floyd B.; Ausburn, Lynna J.
TITLE Learning Task Requirements, Cognitive Styles, and Media Attributes: An Interactive Research Model.
PUB DATE Mar 76
NOTE 11p.; Paper presented at the Annual meeting of the Association for Educational Communications and Technology (Anaheim, California, March 29-April 2, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage
DESCRIPTORS Cognitive Processes; Educational Research; *Haptic Perception; *Individual Differences; *Instructional Technology; *Learning Characteristics; Learning Processes; Learning Theories; Media Research; Stimulus Behavior; *Visual Perception; Visual Stimuli
IDENTIFIERS AECT 76; Cognitive Style

ABSTRACT

In order to investigate learning theories, media researchers need to explore three variables: (1) the psychological requirements of a given learning task, (2) individual differences in cognitive style, and (3) specific media characteristics. It is necessary to identify the psychological processes which underlie any specific learning task in order to study it systematically. There are also differential psychological dimensions that represent consistencies in an individual's manner of acquiring and possessing information, for example Viktor Lowenfeld's haptic and visual types. Since specific attributes are possessed by a given form of media, this three dimensional approach gives strong clues to the reasons why certain instructional methods work well with some learners while having either little or no effect on other learners. Eighteen references are cited. (Author/DS)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED118157

LEARNING TASK REQUIREMENTS, COGNITIVE STYLES, AND MEDIA ATTRIBUTES: AN INTERACTIVE RESEARCH MODEL

Floyd B. Ausburn, Ph.D.
University of Oklahoma

Lynna J. Ausburn
University of Oklahoma

It is the contention of many of today's leading researchers in the field of instructional technology that media research should be related to contemporary psychological inquiry into cognition. It is the belief of these researchers that media is concerned primarily with stimulus presentation and that media research should therefore be largely concerned with the impact of various manipulations of stimulus presentation on the psychological variables of cognition that govern learning. When media researchers have begun to discover the existing interactions among media manipulations and individual differences in cognitive variables in specific learning task situations, to build them into a media design model, and to develop theories of media use, we can perhaps begin to develop a true science of instruction.

Studies which attempt to show some vague, global superiority of one medium or mode of presentation do not meet the needs of current media research. If instructional media, as an academic field, is to gain a solid empirical base and a prescriptive body of theory, its researchers need to concentrate on inquiry into the relationships among at least three specific variables: (1) the psychological requirements of a given learning task, (2) individual differences in cognitive style, and (3) specific media characteristics. Salomon conceptualizes this type of interactive research as:

> ... a three dimensional cube where stimuli, tasks, and individuals interact. The uniting tie is the psychological function that is relevant to a certain learning task and which is accomplished by particular modes of presentation (Salomon, 1970, p. 46).

IR003078

One variable in this cube is the psychological requirements of a given learning task. In a certain task, for example, are learners required to retain visual images mentally through a series of pictures? To remember details of an auditory passage? To make fine visual discriminations? To make visual or verbal associations? It is necessary to identify the psychological processes which underlie any specific learning task in order to study it systematically.

A second variable in the three-dimensional research model is individual differences in cognitive (or perceptual) style. The concept of cognitive style refers to differential pscyhological dimensions which represent consistencies in an individual's manner of acquiring and processing information. Messick (1966) states that cognitive styles represent a person's typical modes of perceiving, remembering, thinking, and solving problems. Kogan offers the following definition of cognitive styles which distinguishes them clearly from abilities:

> Cognitive styles can be most directly defined as individual variation in modes of perceiving, remembering, and thinking, or as distinctive ways of apprehending, storing, transforming, and utilizing information. It may be noted that abilities also involve the foregoing properties, but a difference in emphasis should be noted: Abilities concern level of skill - the more and less of performance - whereas cognitive styles give greater weight to the manner and form of cognition (Kogan, 1971, p. 244).

Numerous dimensions of cognitive style have been identified and studied. Among them, the following have emerged as dominant in research literature:

1. THE VISUAL/HAPTIC PERCEPTION DIMENSION: Through extensive research in the field of art education, Viktor Lowenfeld developed a perceptual typology. He identified individuals of two distinct perceptual types, based on two unlike manners of perceiving and reacting to the world of experiences. He named these two types the visual type and the haptic type, and developed a battery of tests through which perceptual type may be identified (Lowenfeld, 1945). Lowenfeld identified the visual type as one who uses his eyes as his primary sensory intermediaries; is able to see a visual whole, break it into component details, and resynthesize it into a whole; has tendency and ability to visualize tactile and kinesthetic impressions; is able to mentally retain visual images; and tends to react to stimuli

objectively as a spectator. He identified the haptic type as one who is normally sighted but who prefers to use his "body-self" - muscular, tactile, and kinesthetic impressions - as his primary sensory intermediaries; is unable to perceive and analyze visual detail; has no tendency to visualize kinesthetic impressions; cannot mentally retain visual images; and reacts to stimuli subjectively, tending to "feel" situations rather than "see" them (Lowenfeld, 1957). He discovered that approximately 50% of the individuals in his samples were visual, while about 25% were haptic.

The instrument most frequently used to assess perceptual type is Successive Perception Test I (United States Army Air Corps, 1944), a test in motion picture form which was developed originally for use in the World War II Aviation Psychology Program as a part of the pilot selection and training program. Successive Perception Test I (SPT-1) is a refined version of Lowenfeld's original Integration of Successive Impressions (Lowenfeld, 1945), and is based on the same rationale and construct. The primary distinction between visual and haptic types which serves as the basis for both the Lowenfeld test and for SPT-1 is that while visuals have the tendency and ability to integrate partial perceptions into visual wholes, haptics are content to internalize the separate segments of partial impressions and show neither tendency nor ability to integrate them into whole units.

SPT-1 consists of three practice items and 35 actual test items. In each item, the subject views a pattern a small section at a time behind a moving slot and then shown five similar variants from which must be selected the one which matches the pattern seen behind the slot. The instrument has been used numerous times in educational research dealing with perceptual type and visual aptitude with subjects ranging from seventh grade to university level.

2. THE FIELD INDEPENDENCE/FIELD DEPENDENCE DIMENSION: This cognitive style dimension, extensively studied by Witkin and his associates, concerns the ability to perceive details as discrete from their backgrounds and to overcome an

embedding context (Witkin, 1950; Witkin, et al., 1962). The ability to overcome embeddedness is currently the accepted interpretation of field independence. It is viewed as the perceptual aspect of the more pervasive analytic/global cognitive structure.

The Witkin group has relied on three principal tests to assess field independence/dependence: the Body Adjustment Test (BAT), the Rod and Frame Test (RFT), and the Embedded Figures Test (EFT). The BAT consists of a tilting chair within a tilting room, the seated subject being required to adjust the chair to true vertical. The subject's score is the deviation of the chair's adjusted position from the true upright. The RFT presents a luminous rod within a luminous frame in a completely dark room. The subject must adjust the rod to the true vertical when the rod and frame are tilted in either the same or opposite directions. The subject's score is the degree of absolute deviation of the rod setting from true upright. The EFT (Consulting Psychologists Press, 1969) consists of complex geometric patterns in which simple figures are embedded. The subject must locate the embedded simple figures. The amount of time required to do so constitutes the score on the test. Similar to the EFT, and often used in its place because it is a group rather than an individually-administered instrument, is the Hidden Figures Test (HFT; French, Ekstrom, & Price, 1963). In the HFT, the number of simple figures which are located within complex ones in a fixed length of time constitutes the score.

In all of the instruments discussed above, field independent performance, shown by the ability to perform the task, indicates an analytical ability to overcome embeddedness and perceive stimuli as discrete from their backgrounds; while field dependent performance, or poor performance on the task, indicates a global and field-bound perceptual style.

3. THE REFLECTIVITY/IMPULSIVITY DIMENSION: This dimension of cognitive style, studied primarily by Kagan and his associates, concerns the speed with which hypotheses are selected and information is processed. In situations where several

response alternatives are available simultaneously, thus producing response uncertainty, impulsive individuals tend to offer the first answer that occurs to them, even though it is typically incorrect. Reflective individuals, on the other hand, tend to consider various possibilities before deciding, and typically give the correct response (Kagan, 1966; Kagan, et al., 1966).

The instrument which has become the basic index of impulsivity/reflectivity, or cognitive tempo as it is frequently called, is Kagan's (1969) Matching Familiar Figures (MFF). In the MFF, which is available in both children's and adult's forms, the subject must examine a standard in the form of a black and white line drawing of a figure and then look at a group of similar variants and select the one which is identical to the standard. The standard remains in the subject's view at all times, thus eliminating memory as a variable. Dependent measures obtained on the test, which typically show a strong negative correlation for all age groups, are response latency and number of errors on each item and in total. The usual procedure is to classify as reflective those subjects who score above median latency and below median errors, and as impulsive those who score below median latency and above median errors.

4. THE LEVELING/SHARPENING DIMENSION (MEMORY OF PERCEPTIONS OVER TIME): This dimension, studied primarily by Santostefano, Gardner, and Holzman, concerns individual differences in assimilation in memory. Individuals at the leveling extreme tend to blur similar memories in sequentially occurring stimuli and to merge perceived objects and events with similar but not identical events recalled from previous experience. Sharpeners, at the other extreme, are less prone to confuse similar objects and, by contrast, may even judge a current stimulus to be less similar to a past one than it actually is (Santostefano, 1971a).

Several instruments have been used to assess leveling/sharpening tendency. The Schematizing Test (Holzman, 1954) requires the subject to make size judgements of squares of projected light as they gradually shift from being the largest in a series to the smallest. Because the Schematizing Test proved difficult to

administer to children, Santostefano (1964) developed the Wagon Test, in which eight elements of a wagon can be subtracted or added. A newer test developed by Santostefano (1971a), the Leveling-Sharpening House Test, has been used with both children and adults. It consists of 60 black and white line drawings of a scene with a house which contains various details, such a weathervane, a picket fence, a chimney with smoke, windows, etc. Changes are gradually made in the scene, which must be detected by the subject. The intact picture is displayed three times. Then one element (the door knob) is omitted and the picture is again shown three times. An additional element is omitted every three trials until a total of 19 elements is omitted from the original display. The least conspicuous element is eliminated first and the most conspicuous last. The subject is asked to tell the examiner when something looks different from previous pictures. This task yields three measures. The "first stop score" indicates the point at which the subject first reports that something is different. Early detection reflects sharpening. A high number of correct changes reported also reflects sharpening. A "leveling/sharpening ratio" reflects a mean number of changes which go undetected. The smaller this ratio, the greater the operation of sharpening.

In all tasks used to assess leveling/sharpening, sharpening is defined as the ability to accurately identify changes in sequential material, while leveling is defined as the tendency to blur previously encountered stimuli with currently-occurring ones.

5. THE CONSTRICTED/FLEXIBLE CONTROL DIMENSION (FIELD ARTICULATION): This dimension, also heavily studied by Santostefano, concerns individual differences in susceptibility to distraction and contradiction in a visual field. Flexible-control individuals, when dealing with a central task, can selectively withhold attention from intrusive stimuli. Constricted-control individuals, in contrast, have difficulty selectively withholding attention from instrusive stimuli, and their performance on the central task is disrupted by their presence (Santostefano, 1971b).

Field articulation has been most frequently assessed in adults with the Stroop Test (Gardner, et al., 1959), in which words and colors are used to produce distraction and contradiction. For example, the subject might be asked to look at words naming colors which are actually colored differently - i.e., the word "yellow" shown in the color blue - and read the colors in which the words are actually printed. A newer pair of tests developed by Santostefano (1971b) have been used successfully with children up to age 15. These tests are called the Fruit Distraction Tests I and II.

Test I consists of two cards. Card 1 contains 50 randomly distributed drawings of red apples, yellow bananas, blue grapes, and green heads of lettuce. Card 2 is identical to card 1 except that immediately above, below, or to the side of each drawing of fruit is one achromatic line drawing of a non-fruit (shoe, clock, etc.) or food (cake, loaf of bread, etc.). The subject is presented the first card and asked to read aloud the colors of the fruits as rapidly as possible. The examiner records reading times and errors. The same procedure is followed with card 2 which contains the distractors. The subject is told not to pay attention to the distractors but is asked to recall them after completion of the task. Three dependent measures are obtained: (a) reading time distractability score (time to read card 2 minus time to read card 1), (b) reading error distractibility score (errors made on card 2 minus errors made on card 1), and (c) number of distracting stimili recalled from card 2.

Test II consists of two cards containing pictures of fruit. Card 2 contains the same arrangement of fruit as card 1, but the color of each fruit is incorrect. The subject is asked to read aloud the color that each fruit should be. Reading time and reading error differences are calculated. On both tests, flexible subjects have lower error and time distractibility scores than constricted subjects.

Thus far, discussion has been centered on the learning task and cognitive style components of the three-dimensional research paradigm. The final element in the cube of interaction is the specific attributes possessed by a given form of media. A given medium is inherently capable of performing for learners certain functions demanded by learning tasks. This means that various media have various supplantation capabilities. Supplantation is a process which occurs when a mental process is executed explicitly for a learner which he is unable to perform for himself. If a given learner is unable to perform for himself a given mental function which is demanded by a given learning task, then the use of a medium which supplants the required process should logically make the task much easier for him.

This statement indicates the interactive nature of the three variables in the three-dimensional research model, and points the way to productive research in instructional media. For example, instead of devising a study to examine the effects of color coding in general, why not examine the effects of color coding (a characteristic) in a task requiring discrimination of a part from a complex whole (task requirement) with field independent and field dependent individuals (difference in cognitive style). It may be that the task requirement of discrimination of detail can be readily performed without assistance by field independents, while the supplantation provided by color coding is necessary for field dependents. In this instance, an interactive factorial research design would yield valuable knowledge concerning the use of color coding which could not be obtained without considering all three of the variables in the medium/task/learner cube. Very importantly, this approach gives strong clues to the reasons why certain instructional methods work well for some learners while having either no effect or a harmful one on other learners.

As a second example of the three-dimensional research model, ask why one should attempt to study "the effect of using multi-imagery." Instead, why not study the effects when multi-imagery, with its simultaneous visual images (medium variable), is used with visual and haptic learners (cognitive style variable) in a

task requiring comparison of two or three pictures (task requirement variable). The mental process of image retention from picture to picture required by such a task is a difficult one. When the pictures to be compared are shown simultaneously with multi-imagery rather than sequentially, this mental process is supplanted. Does this make the task easier for learners in general? Does it make it easier for haptic learners who have particular difficulty perceiving and storing visual images? Are there vast differences between visuals and haptics in ability to perform this task when sequential imagery is used, but not when simultaneous multiple images are used? The answers to such questions can be found through the application of interactive research methodology. These answers could result in important decisions concerning media utilization.

Using the three-dimensional model of research, many combinations of media characteristics/task requirements/cognitive styles can be generated and studied. The model suggests a system of research which is interactive in nature and which might ultimately lead to a prescriptive body of theory in media utilization. By identifying specific interactions of learner cognitive style characteristics, psychological task requirements, and media supplantation capabilities, it may be possible to develop a body of theory which would allow the accurate prediction of performance on a given task by a learner with given cognitive characteristics and a given mode of task presentation.

REFERENCES

Consulting Psychologists Press. Embedded figures test. Palo Alto, California, 1969.

French, J. W., Ekstrom, R. B., & Price, L. A. Hidden figures test. In Kit of reference tests for cognitive factors. Princeton, N. J.: Educational Testing Service, 1963.

Gardner, R. W., Holzman, P. S., Klein, G. S., Linton, H. B., & Spence, D. P. Cognitive control: A study of individual consistencies in cognitive behavior. Psychological Issues, 1959, 1.

Holzman, P. S. The relation of assimilation tendencies in visual, auditory, and kinesthetic time-error to cognitive attitudes of leveling and sharpening. Journal of Personality, 1954, 22, 375-394.

Kagan, J. Body build and conceptual impulsivity in children. Journal of Personality, 1966, 34, 118-128.

_____. Matching familiar figures. Cambridge: J. Kagan, 1969.

_____, Pearson, L., & Welch, L. Modifiability of an impulsive tempo. Journal of Educational Psychology, 1966, 57(6), 359-365.

Kogan, N. Educational implications of cognitive styles. In G. S. Lesser (Ed.), Psychology and educational practice. Glenview, Illinois: Scott, Foresman and Company, 1971.

Lowenfeld, V. Tests for visual and haptical aptitude. American Journal of Psychology, 1945, 58, 100-111.

_____. Creative and mental growth. New York: Macmillan Company, 1957.

Messick, S. The criterion problem in the evaluation of instruction: Assessing possible, not just intended outcomes. Princeton, N. J.: Educational Testing Service, 1966.

Salomon, G. What does it do to Johnny? A cognitive-functionalistic view of research on media. Viewpoints (Bulletin of the School of Education, Indiana University), 1970, 46(5), 33-63.

Santostefano, S. A developmental study of the congitive control 'leveling-sharpening.' Merrill-Palmer Quarterly, 1964, 10, 343-360.

_____. Leveling-sharpening house test: A procedure for assessing the cognitive principle of leveling-sharpening. Boston: S. Santostefano, 1971a.

_____. Fruit distraction test: A procedure for assessing the cognitive principle of field articulation. Boston: S. Santostefano, 1971b.

United States Army Air Corps, Psychological Testing Division, 1944. Successive Perception Test I. (film)

Witkin, H. A. Individual differences in ease of perception of embedded figures. Journal of Personality, 1950, 19, 1-15.

_____, Dyk, R. B., Faterson, H. F., Goodenough, D. R., & Karp, S. A. Psychological differentiation. New York: John Wiley, 1962.